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A realist evaluation of student use of a virtual reality smartphone application in undergraduate legal education

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Abstract

This paper provides a realist evaluation of the Open Justice virtual reality (VR) smartphone app, designed to develop presentation skills for students on an undergraduate legal education module. This work addresses two research questions: what proportion of students engaged with the Open Justice app, and what worked for whom in what circumstances and why? Questionnaire and interviews were conducted and analysed using a realist evaluation approach. This approach is particularly pertinent to the evaluation of how emerging educational technologies are used, as it can point to the potential affordances of a technological intervention, in addition to assessing its current use. In keeping with the realist evaluation approach, data analysis was completed using the context-mechanism-outcome (CMO) framework.

The findings suggest that more than half of students did not engage with the app during their studies, but this was not surprising as it was a pilot project into using VR with our students and such innovations can be difficult to manage in distance education contexts. Those who did engage with it recognised the potential of immersive VR to contribute to legal skills development, but they found the application of the technology, in this context, to be of limited use.

By utilising a realist evaluation framework, this study contributes to the emerging field of programme theory-based evaluations of educational technology, which might form the basis of further research.

Keywords

Realist evaluation; virtual reality; legal education; CMO framework.

Structured practitioner notes

What is already known about this topic

- Smartphone-based virtual reality technology has developed exponentially and is now widely and cheaply available.
- Smartphone-based virtual reality technology has the potential to develop professional skills, and thereby provide a useful addition to experiential learning pedagogies. This is of particular relevance to the development of professional legal skills in the context of clinical legal education.
- Realist evaluation methodology is increasingly common in health literature to evaluate the impact of education programmes.

What this paper adds

- This is the first empirical study of the use of VR technology to develop professional skills in a distance learning setting.
- This is the first paper to use realist methodology to evaluate virtual reality technology in legal education.
- It provides a granular analysis of particular contexts and user responses that can facilitate or inhibit learner engagement with VR technology.

Implications for practice and/or policy

- It provides an analysis of VR used to support teaching and learning, where the students are distance learners – this highlights issues and challenges to be overcome.
- It provides an evidence base to inform the development of, and further research into, smartphone-based virtual reality for legal education settings.
- It provides a detailed example of how realist methodology can be utilised to evaluate educational technology in real world settings.

Introduction

The purpose of this research is to evaluate undergraduate law students' use of the Open Justice virtual reality (VR) app¹ and thereby provide new insights into the use of VR in legal education settings.

The Open Justice Centre at the UK's Open University introduced a new, optional clinical legal education module (W360: *Justice in Action*) into a distance learning undergraduate law degree in 2017. Clinical legal education is widely used in traditional face-to-face law schools across common law jurisdictions. It refers to the experiential learning methods which engage students in practical public facing activities such as providing legal information, advice or guidance to clients (Bloch, 2011; Giddings, 2013; Jones, McFaul, & Ryan, 2017; Maharg, 2017). Including student participation in public-facing legal projects in a distance learning law degree is a unique and highly innovative development. Clinical legal education methods require students to develop a range of practical legal skills which facilitate their participation in practical legal projects.

Students on this module were offered the opportunity to participate in a variety of projects in schools, prisons, courts, legal charities and online legal advice clinics, many of which required students to develop oral presentation skills. Students were provided with communication and presentation skills training materials to enhance their ability to engage in their clinical work. However, distance learning is recognised as a challenging environment to develop effective presentation skills (McDougall & Holden, 2017; Rogerson-Revell, 2015). In an attempt to overcome this recognised difficulty, the module was designed to incorporate a smartphone based virtual reality application.

¹ Note that the main context of Open Justice refers to the Open Justice Centre <http://law-school.open.ac.uk/open-justice> and the VR app was developed to support students involved in it.

Virtual reality for education

Virtual reality (VR), traditionally very costly and requiring particular technical expertise and specialist equipment, is now starting to enter the mass market. The computer processing power provided by the widespread use of smartphones, in addition to the development of affordable consumer VR headsets, means that VR has the potential to make a significant impact in educational settings (Nwaneri, 2017). This is what Adams *et al* would refer to as ‘catwalk technology’, which has subsequently become ‘ready-to-wear’ (Adams, FitzGerald, & Priestnall, 2013) meaning that the technology is now scalable and widely available (Dede & Richards, 2017). It also has the ability to change current practices as it becomes more widely adopted (Adams *et al.*, 2013).

VR generates realistic digital three-dimensional images, sounds and other sensations to create a simulated setting (Fuchs, Moreau, & Guitton, 2011). Its predominant use has been in the gaming market with augmented and virtual reality products becoming a multi-billion-dollar industry (Nwaneri, 2017). Beyond gaming, the technology has been used in a variety of settings including therapeutic, training and education contexts (Dede & Richards, 2017; Ghanbarzadeh & Ghapanchi, 2018).

The defining feature of VR is the ability to generate immersive presence (Jelfs & Whitelock, 2000; Sanchez-Vives & Slater, 2005; Slater, 2017) which can provide tangible pedagogical benefits (Dede & Richards, 2017), particularly in the context of developing simulated learning opportunities (Dalgarno & Lee, 2010). This argument draws on situated learning pedagogy (Wenger, 1998), where learning is informed by the acquisition of tacit skills through legitimate peripheral participation in authentic activities in the same or similar context to which the learning will be applied. The learner is guided by expert modelling and mentoring by more experienced members of the community of practice. A community of practice reflects the fundamentally social nature of human learning, where a group of people

who share a passion or a concern for how they do something, learn how to do it better through regular interactions with each other. In this project, the community of practice was quite broad, and encompassed other students, the module team, tutors and the developers of the VR app. In providing this community of practice, we enabled the students to have a unique, but realistic practice environment in which to hone their presentation skills, which was pedagogically informed, supported by tutors and designed/developed by colleagues who are accustomed to providing scalable technical solutions. As this was a new technology, and we were taking a somewhat 'bricolage' (or 'tinkering' approach), we expected the outcomes to be variable, depending on students own experiences of the VR app, but that they should feel supported regardless. The community of practice also included these students of course, whose feedback was passed back to the module team, tutors and, crucially, the developers. Thus, the feedback loop has been closed and the experiences of all stakeholders are shared and subsequently help improve the practices of their partners.

Authentic, real world settings are not easy to replicate, but immersive presence offered by VR technologies allows the possibility of simulating contexts that will enable learners to benefit from the authentic peripheral participation that is required for situational learning (Dede & Richards, 2017). In addition, VR offers the potential for authentic environments in which to enact the 'plan, act, reflect' cycle in skills acquisition (Dede, Jacobson, & Richards, 2017) where a learner first prepares for an experience they wish to master, attempt its performance and then assess their effectiveness, which is central to the aims of clinical legal education.

Literature relating to educational applications of VR suggests that it can have a positive impact on learning outcomes in higher education (Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis, 2014). However, there is a recognised need for more empirical studies evaluating the effectiveness of the application of VR technologies in real world

educational settings (Dede *et al.*, 2017). There are few empirical studies on the application of VR to distance learning (Rogerson-Revell, 2015) and, at the time of writing, the authors are not aware of any studies which relate to the introduction of smartphone based immersive VR to distance learning, legal education settings. Consequently, this evaluation is an original and timely contribution to the emerging body of scholarship in the field.

The Open Justice VR app

Students were made aware of the VR app in the module prospectus and in a letter from the Module Chair, which accompanied the delivery of on VR headset to each student. The VR app was developed as a bespoke experiential learning application to provide learners with an immersive simulated environment in which to practise their presentation skills, receive automated feedback and increase their confidence and effectiveness in delivering presentations. Use of the app was not a mandatory feature of the course. The module team opted for a VR based solution as it harnessed the benefits an audio recording tool, a simpler and widely applied technology, but had the benefits of a range of additional features that would present a richer and more authentic learning experience. Key to this was the feeling of immersion, the inclusion of virtual audience members to pose questions, and the ability for a student to ‘see’ themselves present from the point of view of an audience member. The module team wanted to provide students with the opportunity to make their presentation in an immersive environment, which could create a sense of immediacy and assist in building their confidence prior to participation in face-to-face activities. The ability for students to watch themselves present in the virtual world was intended to highlight the importance of focusing on the needs and perspective of the audience when presenting to the public.

The Open Justice app was developed in-house by learning technologists in conjunction with the first author and wider module team during 2017. It provides three virtual

worlds; a prison, community centre and secondary school classroom, each populated with avatars (figures representing audience members) which respond to the presentation by voicing pre-recorded questions. There is also a prototype court room virtual world. Students can upload presentation slides to the virtual world, record their presentation and watch themselves deliver the presentation from the point of view of an audience member. The app also scores the presenter's 'eye contact' (i.e. gaze) with the audience and where a presenter fails to make eye contact with particular members of the audience, those avatars begin to behave restlessly. It is designed to be used on a smartphone in conjunction with a basic handheld VR headset which was provided to students (see Figure 1 below). The app is freely available for both iOS and Android devices and can be found by searching for 'Open Justice VR.'

*Figure 1: VR headset provided to students on the course
(Google Cardboard version 2 design)*



The additional figures below (Figures 2-7) illustrate the interface that students interacted with whilst using the Open Justice VR app.

Figure 2: View from the student's perspective on entering the VR classroom environment



Figure 3: Student's (presenter's) perspective of the classroom and its avatars



Figure 4: Student's control panel within the VR environment, controlled by gaze and clicking a button on the headset

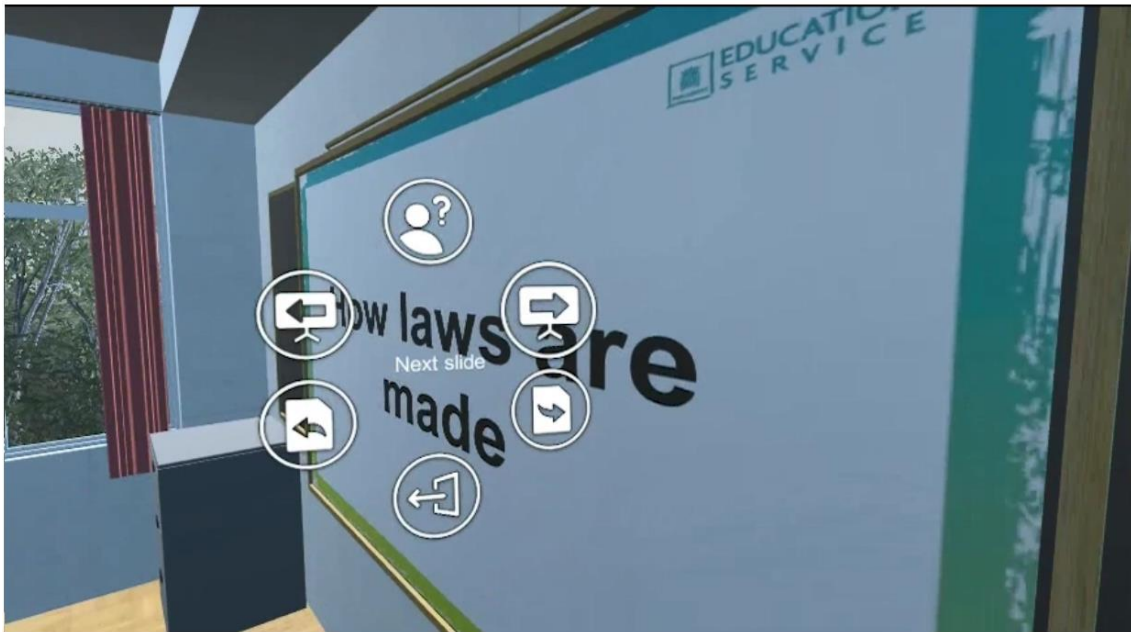


Figure 5: Student's (presenter's) perspective of the whiteboard at the front of the classroom, where their presentation is shown to the class

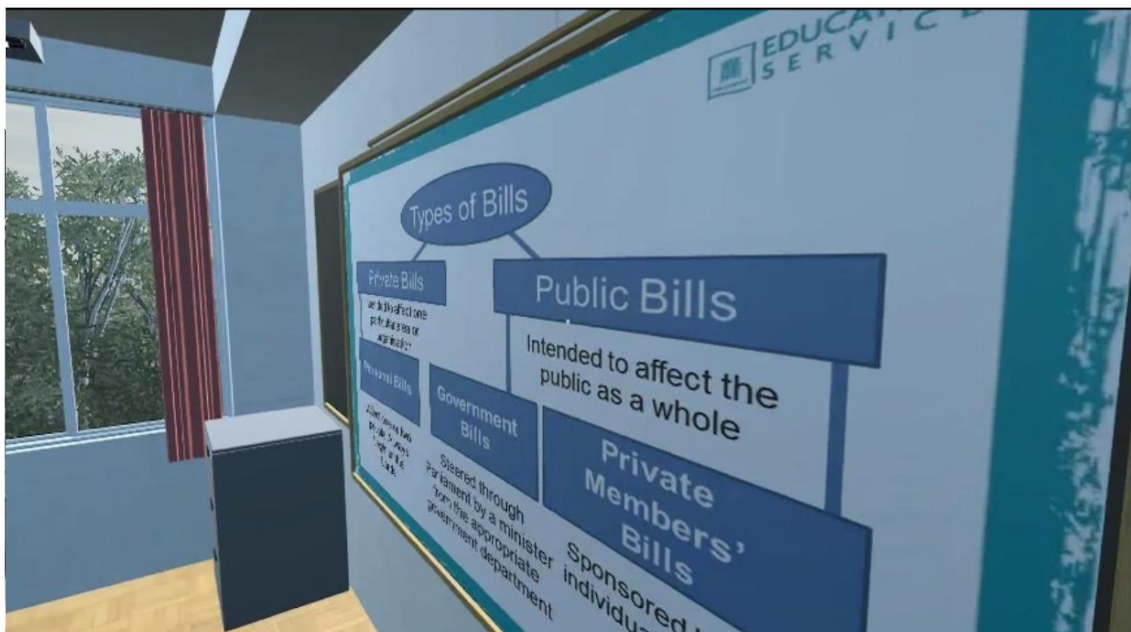


Figure 6: student's perspective in the environment – here they are using the 'cue card' function to help them remember their script for the presentation

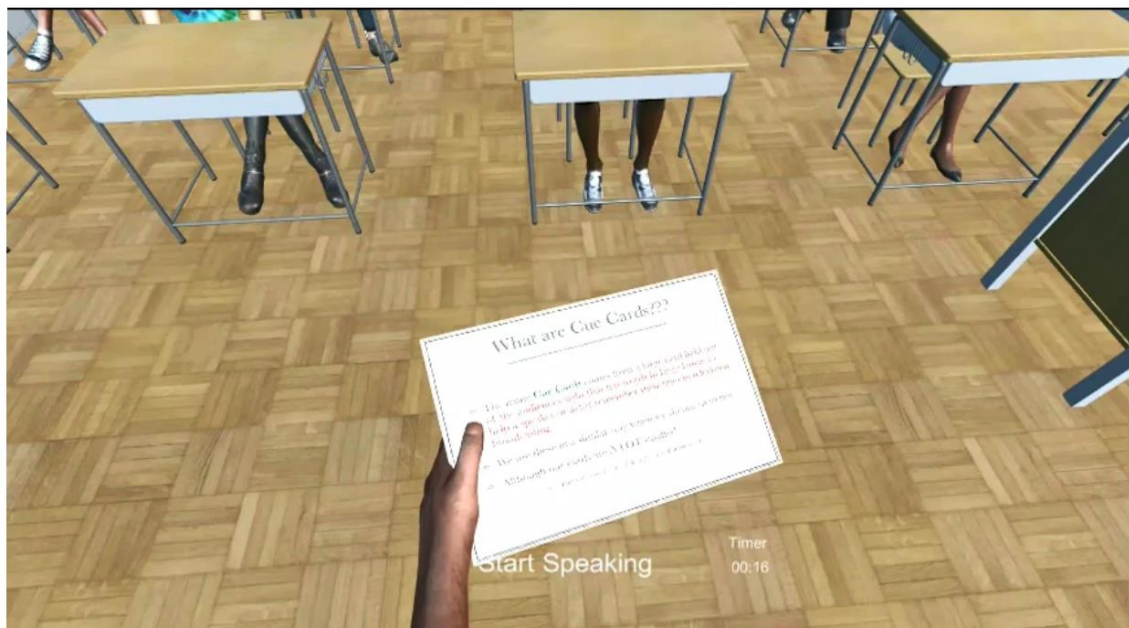
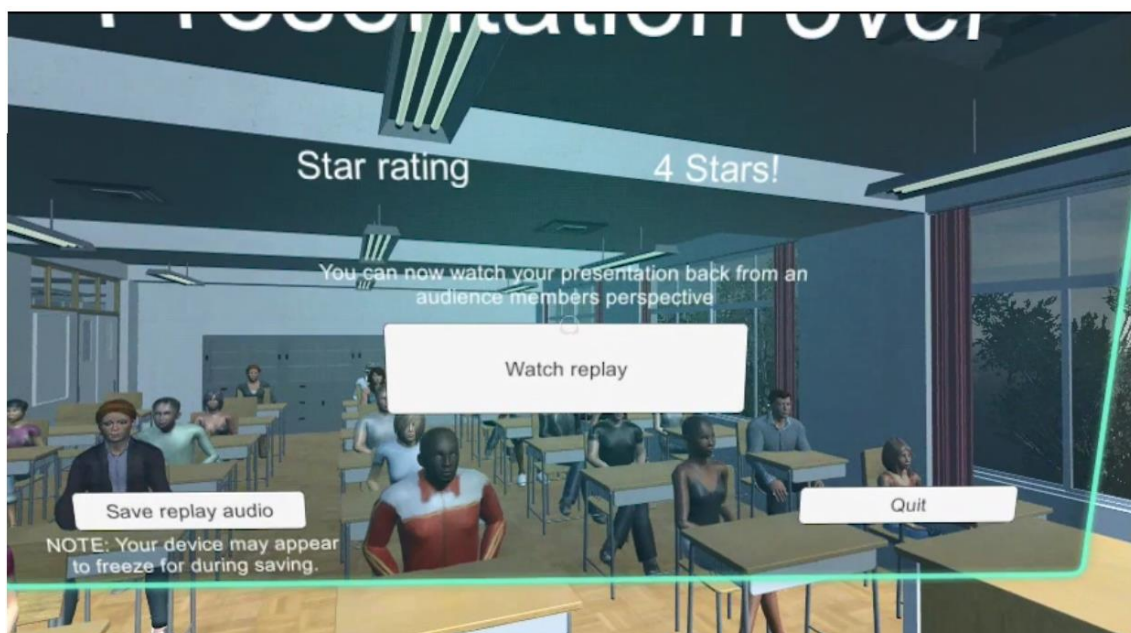


Figure 7 – the control screen once the presentation has finished: students can replay from an audience's perspective, save the replay or quit



Methodology

This study employs a realist evaluation framework and asks two specific research questions: what proportion of students engaged with the app, and secondly, what worked for whom in what circumstances and why?

A realist approach was chosen for two reasons. Firstly, it offered a framework to analyse student responses to the Open Justice app in a way that went beyond a superficial, binary account of whether they engaged with the technology or not. The realist framework facilitates an investigation of what worked for whom, in what circumstances and why. This granular approach is able to identify aspects of the technology that may not have been successfully applied in this context, but could be transferred successfully to other contexts, thereby illuminating potential future opportunities of particular technologies, as well as current usage (Liu, Dede, Huang, & Richards, 2017). Secondly, realist evaluation is recognised as an appropriate vehicle for the evaluation of clinical simulations in the health care setting (Graham & McAleer, 2018; Ogrinc & Batalden, 2009; Wong *et al.*, 2016) and for novel educational technology applications (King, Rothberg, Dawson, & Batmaz, 2016). The introduction of the new VR app was an attempt to enable students to immerse students in authentic practice while stimulating a clinical setting.

By utilising the realist evaluation framework, this paper offers new insights into the potential affordances of VR technology for the development of skills in clinical legal education settings. Consequently it is, in part, a response to calls for theory-based evaluations of the uses of educational technology (Gunn & Steel, 2012; King *et al.*, 2016; Selwyn, 2014) and therefore makes a timely and original contribution to this growing area of educational scholarship.

The research design includes the use of questionnaires and interviews (as detailed later in this paper) to elicit data to address our research questions. Approval for the study was

granted by the host institution ethics committee and all relevant procedures were followed, including obtaining the informed consent of the participants and taking steps to protect participant confidentiality. This committee also scrutinised and approval the questionnaire and interview protocols. Both the questionnaire and interview protocol were written explicitly for this project, and investigated the usage of the app and the student experiences of it, in relation to the wider module study aims and the development of students' presentation skills. A copy of the questionnaire can be found at <http://tinyurl.com/BJET-VR-questions> and a copy of the interview protocol is available at <http://tinyurl.com/BJET-VR-interviews>.

A realist approach

Realist evaluation, developed by Pawson and Tilley (1997), offers a logic of enquiry that is based on a realist ontology and relativist epistemology. It posits the existence of an independent reality but knowledge of it is unavoidably relative to the researcher (Marchal, Van Belle, Van Olmen, Hoérée, & Kegels, 2012). It presupposes a generative understanding of causality; social actors have agency and, as human action is embedded in a wide range of social processes, social relations can function as causal mechanisms (Marchal *et al.*, 2012).

The realist approach is suitable for the evaluation of social programmes which offer a resource to which participants make a reasoned response (Pawson & Tilley, 2004). The element of human reason on the part of those delivering and responding to the resource is central to understanding the intervention. Realist evaluation takes the view that it is not the intervention itself that makes a programme work, but rational agents, through their reasoning and reactions to it (Wand, White, & Patching, 2010). This was a key consideration in the development of the research design for this study, as students responded to the introduction of the VR app as rational agents, and the aim was to evaluate how and why they decided to use it in the way that they did.

In addition, the realist evaluator recognises that the rational agents responding to the intervention do so within a particular social context (Pawson & Tilley, 2004). Where the orthodox approach to evaluation might ask whether an intervention has worked, the realist evaluator accepts that social programmes will work for certain people in certain circumstances and they endeavour to make these patterns of success and failure explicit. Thus, they ask, ‘what is it about this kind of intervention that works, for whom, in what circumstances, in what respects and why?’ (Pawson & Tilley, 2004).

Graham and McAleer (2018) argue this has the potential to provide greater explanatory value, and is of relevance to educational programmes where learning outcomes are likely to operate in a graduated rather than in a binary understand/not understand, skilled/not skilled manner. This feature of realist evaluation informed the design of this study, as it was anticipated that students would engage with the Open Justice app in different ways, some making more use of it than others. In this study, care was taken to try to understand the contextual factors that inhibited, or facilitated, engagement with the VR app. The research aimed to understand student engagement in a graduated, rather than binary way.

Analysis using CMO configurations

The realist evaluator seeks to analyse social interventions by identifying CMO configurations (Context + Mechanism = Outcome), which provide an explanatory account of a social intervention. In doing so, we are able to adjust and refine the theories on which the intervention was based and provide transferable insights on how to develop and improve interventions (Pawson & Tilley, 2004). This study aimed to ‘open the black box’ and give rich evaluation of student use of the Open Justice app and in doing so provide transferrable insights into how VR technology could be developed to support professional skills development in higher education.

Realist evaluation method

Pawson and Tilley (1997, 2004) suggest four stages to guide a realist evaluation which can be summarised as follows. Stage 1 requires the researcher to articulate the programme theory to be tested; to outline how the programme mechanisms will generate the desired outcome(s) in the particular context(s) the intervention is operating. Stage 2 involves collecting data to test this hypothesis. Stage 3 involves analysing the data in terms of CMO configurations, thereby testing the initial hypothesis and generating a transferable understanding of what worked for who in what circumstances and why. Stage 4 will result in refinement of the original hypothesis for further testing. Each stage has informed the research design of this study, as will be demonstrated below.

Stage 1 – Programme theory

The programme theory is the launchpad of realist evaluation and involves ‘bringing the imagination to bear in ‘thinking through’ how a programme works’ (Pawson & Tilley, 2004, p. 10) It can be informed by a wide range of sources including ‘programme architects, practitioners, previous evaluation studies and social science literature’ (Pawson & Tilley, 2004, p. 10). The initial programme theory used for this study is outlined in the statement below and a breakdown of the anticipated CMO configurations are given in Table 1. It was informed by the expectations of the developers of the VR app and the module authors, in addition to the literature summarised in the introduction.

The programme theory for this study can be articulated as:

Making the Open Justice VR app available to students studying this module (context) will lead to participants choosing to use the app to practice their presentation skills (mechanism) and will improve their ability and confidence in giving real world presentations (outcome).

A more detailed breakdown of the CMO configurations for this initial programme theory is given in Table 1 below.

Table 1: CMO configurations of initial programme theory

Context	Mechanism	Outcome
C1 Final year law students	M1 Students will take time to familiarise themselves with the VR APP	O1 Increased confidence in giving presentations
C2 Have received some presentation skills training	M2 Students will practice their presentations within an immersive virtual reality environment	O2 Increased understanding of importance and relevance of communication skills
C3 Will have opportunity to apply presentation skills in real world settings	M3 Students will fully utilise the feedback functionality provided in the VR app	O3 Identify and set goals for improving real world presentation skills
C4 Varying levels of confidence and experience in giving presentations	M4 Students will use the VR app to practice and refine their real world presentation	O4 Foster the understanding of the relevance and importance of transferrable professional skills

Stage 2 – Data collection to test the programme theory

Realist evaluation is methodologically neutral; any method that will help open the ‘black box’ of the programme mechanisms can be utilised. Consequently, data collection involved small scale surveys, utilising interviews and a questionnaire. The questionnaire

provided insights into the proportion of students who had used the app, while the interviews provided more granular insights into the way students had responded to the technology.

Questionnaire

A questionnaire was used to find out how many students engaged with the app. Of the 95 students in the cohort, 28 responded to the electronic questionnaire (distributed midway through the module) which asked whether they had made use of the VR app during their studies.

Interviews

Participants were invited to answer semi-structured questions during recorded telephone interviews. Telephone interviews were preferred to a focus group due to logistical constraints of arranging a face-to-face meeting with distance learning students.

Ten participants were invited to take part. These were selected at random from a pool of eleven students who had returned the questionnaire and indicated that they had used the VR app. Six students agreed to participate. Participants were interviewed for up to one hour. Consistent with the realist approach, the interview design used open questions aimed to generate data on students' perceptions of the usefulness of the VR app. Each interview explored the student's perception of the accessibility of the technology, its relevance and potential relevance to their studies, the extent to which they used the technology and which aspects of it they found particularly useful or particularly challenging.

The interview participants consisted of three males and three females. Four participants were in the 40-60-year age group and two were in the 20-30 age range (consistent with the demographic of The Open University, which has a higher than average proportion of mature students). However, unusually for the Open University, which

predominantly recruits part time learners, five out of the six students were studying at a full time equivalent study intensity.

Stage 3 analysis of data into CMO configurations

Realist evaluation seeks to explore the causal relationship between the intervention's contexts, mechanisms and outcomes (Pawson, 2006). The analysis of the data therefore intended to identify a set of contexts, mechanisms and outcomes, but also to seek to identify sequences of CMO linkages or CMO configurations which expressed a possible causal relationship.

Recordings of the interviews were transcribed and analysed using content analysis and informed by the context-mechanism-outcome configuration relevant to realist evaluation (Berge, 2017). Phrases were coded as **context** where they related to the contextual factors surrounding student use of the VR app. They were coded as **mechanisms** where they related to the participants response to the VR app and as **outcomes** if it related to the impact of the VR app on the participants (Berge, 2017; Pawson, 2006). Recurring codes were amalgamated into context, mechanism and outcome themes.

Analysis of the interview data revealed 5 context themes, 5 mechanisms, and 3 outcomes outlined in the table below and discussed further under the following subheadings. These CMO themes were then used to propose explanatory CMO configurations which would test the validity of the initial programme theory and thereby provide an evaluation of student use of the VR app. The quotes included in the results section below were selected as being the best representation of the point under discussion.

Results

The results from the questionnaire indicate that a minority of students used the VR app during their studies. 40% of those who responded to the questionnaire reported using the VR app and 60% reported not using it at all. This was lower than was hoped by the module team and VR developers, who considered that the majority of students would have made at least some use of the VR app. However, as use of the app was an optional activity rather than compulsory, these results are hardly surprising.

The analysis of the interview data offers insights into student use of VR app, including its current and potential utility in the development of professional skills. In keeping with the realist evaluation framework, the interview data is presented below in the form of context, mechanism and outcome themes, summarised in outline in Table 2, and explained further below.

Table 2: Summary of CMO themes from interview data

Contexts	Mechanisms	Outcomes
C1 Time limitations	M1 Disappointment with the quality and functionality of the VR app and Headset	O1 Did not use the VR app to practice presentation skills after the first attempt
C2 Relationship to the wider module	M2 Perception that VR technology was beyond their technical capabilities	O2 Used other means to practice presentation skills
C3 Lack of confidence or anxiety in engaging with new technology	M3 Valued the generation of presence within VR and the potential for group collaboration but the current	O3 Used the full functionality of the VR app to practice presentation skills.

	version did not warrant time required to use it.	
C4 Readily available expert assistance	M4 Perceived lack of incentives to put the time into learning how to use the VR app	
C5 Quality and functionality of VR app and VR Headset	M5 Valued the generation of ‘presence’ within VR and perception that it was useful and worth time to understand how to use it	

Contexts

Context describes those features of the conditions in which programmes are introduced that are relevant to the operation of the programme mechanisms, it is expected that some contexts will support the programme theory and others will not (Pawson & Tilley, 2004).

C1 Time limitations

‘I had a lot of stuff on.’

Participants were all in the final year of the law degree and the majority were studying multiple modules at a full time equivalent rate, which is unusual for a predominantly part time distance learning University. The data highlighted students felt that there were considerable pressures on their time, which they perceived as an obstacle to engaging with the VR app.

C2 Relationship to the wider module

‘If ...you get grades on it as part of your assessment, I think it would have worked better’

The interview data shows that participants were influenced by the fact that the VR app was not directly related to a summative assessment. They perceived using the technology as an optional aspect of the module, which impacted on the amount of time they allocated to engaging with the VR app.

C3 Lack of confidence or anxiety in engaging with new technology

‘It did tend to be a little bit above me, above my capability ... I couldn’t quite fathom out how I was supposed to do that.’

The interview data shows that participants were nervous about dealing with the new technology, expressing anxieties about their ability to use it, or that it would take too much of their available study time to learn how to use it. *‘I just thought that it was going to take me too long to figure out how to do it.’*

C4 Readily available expert assistance

‘I asked my brother to help me because he’s studying computing.’

One participant had the benefit of a family member with expertise in smartphone based VR which provided easily accessible assistance in utilising the VR app.

C5 Quality and functionality of VR app and VR Headset

‘It just didn’t work. Everything was glitching...the goggles... were incredibly basic’

Participants were frustrated by some aspects of the functionality of the VR app. This included experiencing difficulties with the VR headset in addition to the performance of the

VR app on their smartphone. The functionality of the VR app and headset was therefore seen as an obstacle to its use.

Mechanisms

Programme mechanisms are interaction between the programme resources and how participants interpret and respond (or not) to them and thus focus on the changes in reasoning and behaviour of individuals and an explanation of why and how programmes give rise to outcomes (Pawson & Tilley, 1997; Wong *et al.*, 2016).

M1 Disappointment with the quality and functionality of the VR

'It needed to work properly. So whilst it would have been a great boost, a great bonus, if that had worked properly...but it didn't.'

Although one student did not find any fault with the current version of the VR app, most participants reported different degrees of dissatisfaction with the functionality of the software (possibly due to variability in users' smart phone specifications). Participants found the VR headset not to be fit for purpose, *'That was probably the biggest ... downside... the actual headset itself.'* Perceived issues with the headset included the absence of a head strap to hold it in place, requiring users to hold the headset to their face, which meant that they were unable to use their hands during the presentation. Others reported that the headset was uncomfortable and that the quality of the visual simulation provided was blurred and caused headaches.

Other perceived snags included the difficulty experienced in uploading the presentation slides into the virtual world and the responsiveness of the VR app to user commands whilst in the virtual world. The data also pointed to some associated anxieties stemming from the fact the software relied on being installed on a smartphone which led to

concerns around being called whilst using the app or the phone being damaged by the headset.

M2 Perception that VR technology was beyond their technical capabilities

‘It didn’t appear as simple to me as I was hoping it would be.’

This was coupled with a perception, particularly by the older respondents, that the technology was intimidating and inaccessible, *‘it seemed to be a little bit above what I was, what I, what I thought I was capable of doing.’* Although it was acknowledged that the perceived difficulty of using the VR app was in part due to it being an unfamiliar and emergent technology: *‘there is a hurdle, resistance to trying anything new; and you need to, I think you need to somehow overcome that.’*

M3 Valued the generation of presence within VR and the potential for group collaboration but current version did not warrant time required to use it

‘It gives you that, kind of, illusion that you’re presenting to real people’

The opportunity to learn and then practice a skill in an immersive virtual environment was recognised as having a distinct pedagogical benefit which would assist in them achieving the learning objectives in the module despite the difficulties some had experienced in making use of the technology. Participants recognised that the ability to receive computer generated feedback on their performance provided a good opportunity to reflect on their performance prior to transferring their presentation skills to a real-world setting.

The data points to several specific ways in which the software could be developed to maximise its pedagogical effectiveness including improving the headset, developing the graphics, integrating participant recordings using the VR app into the assessment regime of the module and developing a multi user function. Developing a multi user function would

include features where students could take the role of audience members represented by avatars and ask questions, facilitate group delivery of presentations and allow module tutors to enter the virtual world for assessment, feedback or teaching purposes. Being able to access the virtual world synchronously with other students was perceived as being of significant value and would increase the level of student engagement with the software. *‘I think it would add a bit of an element of ... fun to this ... I think that they would enjoy that and they would engage with the work itself more.’*

M4 Perceived lack of incentives to put the time into learning how to use the VR app

‘it wasn’t actually a required part of the module and it didn’t work very well’

The data shows that participants felt insufficient incentive to invest the time necessary into overcoming perceived barriers and familiarising themselves with how to gain the full use from the VR app.

M5 Valued the generation of ‘presence’ within VR and perception that it was useful and worth time to understand how to use it

I immediately felt that I was actually in the presentation room and I had to come up with the answer and I felt immediately under pressure

In the absence of barriers to the use of the VR app, one participant did recognise the value of using the app and persisted with it to reinforce their skills development.

Outcomes

Outcome-patterns comprise the intended and unintended consequences of programmes, resulting from the activation of different mechanisms in different contexts (Pawson & Tilley, 2004).

O1 Did not use the VR app to practice presentation skills after the first attempt

'We're doing other modules so I think having to take time to learn new software, I think that was the issue... so I didn't really utilise the opportunity to use it.'

The barriers to using the app were such that most participants did not spend time using the VR app to practise their presentation skills after the first attempt to use it.

O2 Used other means to practice presentation skills

'it didn't feel necessary to do the run through via the VR because it was ...so I just went through my bit in person with my family'

Participants reported bypassing the VR app and found other means to practise the presentation skills.

O3 Used the full functionality of the VR app to practice presentation skills.

'It felt amazing actually because...it was going to be useful for the actual real presentations because it gave me...some pre-experience in that kind of ... environment. I thought it was a really, really good thing.'

One participant reported making use of the app to practice and improve their presentation skills in a way that was anticipated by the programme theory.

Testing and the programme theory using CMO configurations

Stage 3 of the realist evaluation calls on the researcher to use the data to test the initial programme theory. Pawson and Tilley (2004, p. 11) argue that a realist investigator should expect 'a nuanced outcome pattern of successes and failures within and across interventions.' The data fulfils this expectation as it does not provide a unified pattern. Whereas most of the data does not support the initial programme theory, one interview participant provides data that largely supports it. The explanation for this seems to derive from a specific contextual

factor that relates to the participant's confidence in being able to navigate the technology.

This specific contextual factor seems to have been sufficient to fire the anticipated programme mechanisms and lead to the intended outcome.

Elsewhere the data reveals three additional context, mechanism and outcome configurations that were not anticipated in the original programme theory. Firstly, students lacked confidence in their ability to use technology (context) and felt no incentive to seek help to try to use it (mechanism) so they either did not engage or engaged in only a limited manner with the VR app (outcome). Secondly, students had limited study time available (context) and were disappointed with the quality and functionality of the VR app and did not feel a sufficient incentive to spend time using the VR app (mechanism) they used other means to practice their presentation skills (outcome). Finally, students had limited study time (context), although they valued the generation of presence provided by VR the current version did not warrant time required to use it (mechanism) therefore the VR app was not used as much as it would have been if the functionality issues were improved (outcome).

Stage 4 – Refining the programme theory

As an iterative process, stage four of the realist evaluation framework prompts the evaluator to refine the initial programme theory in response to its testing at Stage 3, which in turn invites further research. The following refined programme theory is offered, to be tested by further research:

Students studying distance learning clinical legal education programmes who have sufficient time, confidence, incentive and support to access good quality smartphone based immersive virtual reality (context) will respond positively to the opportunity to practice professional skills in an immersive environment (mechanism) which will

improve their understanding and confidence of how to apply professional skills in real world settings (outcome).

Discussion

The rationale for this study was to provide a realist evaluation of students' use of a new virtual reality smartphone application (VR app), which had been designed to support skills development in the context of an undergraduate clinical legal education module. This study provides evidence on the obstacles that can inhibit the successful incorporation of virtual reality technology into clinical legal education programmes. The results demonstrate that students did not perceive the software to be of sufficient value for them to invest time into using it during the module. This finding is in agreement with the literature in providing evidence that the time investment required in learning how to use new technology is a barrier to its utilisation (Dede & Richards, 2017; King *et al.*, 2016; Seielstad, 2012). In addition, the limited student engagement revealed by the study further supports the literature by demonstrating the need for careful integration of the technology into the learning outcomes of the module; pedagogy should drive the use of the technology, rather than the technology driving the pedagogy (FitzGerald *et al.*, 2013). However, scalable VR is an emergent technology and with emergent technologies, its affordances aren't always evident until we truly understand its capabilities. Other perceived barriers that mitigated against student use of the technology included functionality and quality issues around the software and headset; difficulties which are consonant with the introduction of emerging technologies but which also points to the level of investment required in developing technologies that are fit for purpose, a finding that is also echoed in the literature (Dede *et al.*, 2017).

The findings of this study need to be interpreted in light of its limitations. These include the modest number of participants, the particular context of a distance learning education setting and the fact that participants were recruited from only the first presentation

of the module. These limitations are mitigated by the use of realist methodology, a defining feature of which is its attempt to uncover local causality in particular contexts which reveal semi-predictable patterns of human behaviour (Sorinola, Thistlethwaite, Davies, & Peile, 2017). This study offers a granular analysis of the effects of particular interactions with VR technology and has led to a revised programme theory that functions as a focus for further research into the elements necessary for the successful incorporation of virtual reality into clinical legal education settings. Two further limitations relating to the practical application of the realist evaluation framework can also be highlighted. Firstly, realist methodology has rarely been applied to the evaluation of educational technology (King *et al.*, 2016; Marchal *et al.*, 2012) and, as an emergent theoretical framework, a settled consensus on its practical application has yet to emerge (Marchal *et al.*, 2012; Wong *et al.*, 2016). Secondly, other authors have reported the difficulties in clearly differentiating between contexts and mechanisms (Carter & New, 2004; Schofield & Tolson, 2010; Sorinola *et al.*, 2017). Consequently, particular care was taken in the attribution of these concepts during the data analysis phase of this study.

Conclusion

This empirical study is the first to evaluate student use of smartphone based virtual reality in distance learning clinical legal education. Also, in its use of the realist evaluation framework, it offers a response to calls for theory-based evaluations of novel educational technology applications. This study has demonstrated that utilising a realist approach to the evaluation of novel learning environment can yield a depth of insight which can inform the future development and application of educational technologies. It provides new knowledge regarding the contexts and mechanisms relevant to the use of VR in higher education and has developed a refined programme theory which can form the basis of further research. As such,

it is of relevance to policy makers, researchers and educationalists interested in the implementation of VR into higher education.

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Statements on open data, ethics and conflict of interest

- a. Anonymised data from this study is available upon request from the lead author.
- b. The study carried out in line with research ethics procedures at the Open University and was approved by the Student Research Project Panel (SRPP 2018/070).
- c. The authors report no conflict of interest.

References

- Adams, A., FitzGerald, E., & Priestnall, G. (2013). Of Catwalk Technologies and Boundary Creatures. *ACM Transactions of Computer-Human Interaction*, 20(3), Article No. 15.
- Berge, M. S. (2017). Telecare - where, when, why and for whom does it work? A realist evaluation of a Norwegian project. *Journal of Rehabilitation and Assistive Technologies Engineering*, 4, 1-10. doi: 10.1177/2055668317693737

- Bloch, F. (2011). *The Global Clinical Movement: Educating Lawyers for Social Justice*. Oxford: Oxford University Press.
- Carter, B., & New, C. (2004). *Making realism work*. New York (NY): Routledge.
- Dalgarno, B., & Lee, M. J. W. (2010). What are the learning affordances of 3-D virtual environments? *British Journal of Educational Technology*, 41(1), 10-32.
- Dede, C., Jacobson, J., & Richards, J. (2017). Introduction: Virtual, Augmented, and Mixed Realities in Education. In D. Liu, C. Dede, R. Huang, & J. Richards (Eds.), *Virtual, Augmented, and Mixed Realities in Education* (pp. 1-18). Singapore: Springer.
- Dede, C., & Richards, J. (2017). Strategic Planning for R&D on Immersive Learning. In D. Liu, C. Dede, R. Huang, & J. Richards (Eds.), *Virtual, Augmented, and Mixed Realities in Education* (pp. 237-244). Singapore: Springer.
- FitzGerald, E., Ferguson, R., Adams, A., Gaved, M., Mor, Y., & Thomas, R. (2013). Augmented reality and mobile learning: the state of the art. *International Journal of Mobile and Blended Learning*, 5(4), 43-58.
- Fuchs, P., Moreau, G., & Guitton, P. (Eds.). (2011). *Virtual reality: Concepts and technologies*. Boca Raton: CRC Press.
- Ghanbarzadeh, R., & Ghapanchi, A. H. (2018). Investigating various application areas of three-dimensional virtual worlds for higher education. *British Journal of Educational Technology*, 49(3), 370-384.
- Giddings, J. (2013). *Promoting Justice through Clinical Legal Education*. Melbourne: Justice Press.
- Graham, A. C., & McAleer, S. (2018). An overview of realist evaluation for simulation-based education. *Advances in Simulation*, 3(13). doi: <https://doi.org/10.1186/s41077-018-0073-6>

- Gunn, C., & Steel, C. (2012). Linking theory to practice in learning technology research. *Research In Learning Technology*, 20(2), 203-216. doi: <http://dx.doi.org/10.3402/rlt.v20i0.16148>
- Jelfs, A., & Whitelock, D. (2000). The notion of presence in virtual learning environments: what makes the environment “real”. *British Journal of Educational Technology*, 31(2), 145-152.
- Jones, E., McFaul, H., & Ryan, F. (2017). Clinical legal education in the United Kingdom: Origins, growth and the technological innovations and challenges of its future. *German Journal of Legal Education*, 4, 107-136.
- King, M. R. N., Rothberg, S. J., Dawson, R. J., & Batmaz, F. (2016). Bridging the edtech evidence gap: A realist evaluation framework refined for complex technology initiatives. *Journal of Systems and Information Technology*, 18(1), 18-40.
- Liu, D., Dede, C., Huang, R., & Richards, J. (Eds.). (2017). *Virtual, Augmented, and Mixed Realities in Education*. Singapore: Springer.
- Maharg, P. (2017). The Periclean plumber: simulation and legal education. In B. Bergmans (Ed.), *Jahrbuch der Rechtsdidaktik 2016/Yearbook of legal education 2016* (pp. 187-212). Berlin: BWV Berliner Wissenschafts-Verlag.
- Marchal, B., Van Belle, S., Van Olmen, J., Hoérée, T., & Kegels, G. (2012). Is realist evaluation keeping its promise? A review of published empirical studies in the field of health systems research. *Evaluation*, 18(2), 192-212.
- McDougall, J., & Holden, H. (2017). The silence about oral presentation skills in distance and online education: new perspectives from an Australian university preparatory programme. *The Journal of Open, Distance and e-Learning*, 32(2), 163-176.

- Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. *Computers & Education, 70*, 29-40.
- Nwaneri, C. (2017). Ready Lawyer One: Legal Issues in the Innovation of Virtual Reality. *Harvard Journal of Law & Technology, 30*(2), 601-627.
- Ogrinc, G., & Batalden, P. (2009). Realist evaluation as a framework for the assessment of teaching about the improvement of care. *Journal of Nursing Education, 48*(12), 661-667.
- Pawson, R. (2006). *Evidence-based policy: a realist perspective*. London: Sage Publishing Ltd.
- Pawson, R., & Tilley, N. (1997). *Realistic evaluation*. London: Sage.
- Pawson, R., & Tilley, N. (2004). *Realist evaluation*: Sage Publications Ltd, London
- Rogerson-Revell, P. (2015). Constructively aligning technologies with learning and assessment in a distance education master's programme. *Distance Education, 36*(1), 129-147.
- Sanchez-Vives, M. V., & Slater, M. (2005). From presence to consciousness through virtual reality. *Nature Reviews Neuroscience, 6*(4), 332–339.
- Schofield, I., & Tolson, D. (2010). Scottish football museum reminiscence pilot project for people with dementia: a realistic evaluation. Glasgow: School of Health, Glasgow Caledonian University.
- Seielstad, A. M. (2012). Enhancing the teaching of lawyering skills and perspectives through virtual world engagement. *University of Massachusetts Law Review, 7*(1).
- Selwyn, N. (2014). *Distrusting educational technology: critical questions for changing times*. London: Routledge.

- Slater, M. (2017). Implicit Learning Through Embodiment in Immersive Virtual Reality. In D. Liu, C. Dede, R. Huang, & J. Richards (Eds.), *Virtual, Augmented, and Mixed Realities in Education*. Singapore: Springer.
- Sorinola, O. O., Thistlethwaite, J., Davies, D., & Peile, E. (2017). Realist evaluation of faculty development for medical educators: What works for whom and why in the long-term. *Medical Teacher*, 39(4), 422-429.
- Wand, T., White, K., & Patching, J. (2010). Applying a realist(ic) framework to the evaluation of a new model of emergency department based mental health nursing practice. *Nursing Inquiry*, 17(3), 231-239.
- Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge, England: Cambridge University Press.
- Wong, G., Westhorp, G., Manzano, A., Greenhalgh, J., Jagosh, J., & Greenhalgh, T. (2016). RAMESES II reporting standards for realist evaluations. *BMC Medicine*, 14(1), 96.